MICRO CASE 3 --- streptococcus pyogenes

A **six-year-old** girl came home from school feeling miserable on a cold day in January. She had a **high fever** and complained of an **itchy throat**. She had **difficulty swallowing** any food, refused to eat, and cried amost all evening. The next day her grandfather took her to their family physician’s clinic. It was noted that several children from her school had reported sore throats recently.

The patient had received all standard childhood’s immunizations at the appropriate times.

* PHYSICAL EXAM:
  + Red throat (pharyngeal e**rythema**) with **petechiae** (small red spots) on the soft palate
  + **Patchy grayish-white tonsillar exudates**
  + **Enlarged and tender anterior cervical lymph nodes**
  + Patient **DID NOT HAVE ANY COUGH**
* DIAGNOSTIC WORK UP
  + Monospot test to rule out EBV
  + Rapid Ag test (RADT) (if negative, must confirm with throat culture; if positive, confirms diagnosis of streptococcus)
  + Throat culture
* DIFFERENTIAL:
  + Adenovirus, Coronavirus, EBV, Influenzae, Rhinovirus, Streptococcus (Groups C or G), Streptococcus pyogenes (Group A streptococcus)
  + Rationale:
    - All the above may cause pharyngitis. The patient had pharyngitis. Because it affects therapeutic decision making, it is important to attempt clinical differentiation between viral and bacterial pharyngitis. The clinical presentations for viral and bacterial pharyngitis overlap broadly. Viruses more common cause. Mild pharyngeal symptoms with rhinorrhea suggest a viral etiology. **High fever, tonsillar exudates, anterior cervical lympadenopathy, and the absence of cough are the best predictive clinical features for bacterial pharyngitis** or EBV infection. EBV is less likely to be symptomatic in this age group.
* Source = Streptococcal pyogenes (streptococcal pharyngtitis)
* MICROBIOLOGICAL PROPERTIES
  + **Gram positive cocci in chains**
  + **Clear, sharp β-hemolysis on blood agar**
  + **Catalase negative**
  + **Bacitracin sensitive**
  + **S. pyogenes = Group A β-hemolytic streptococcus (Group A cuz Group A carbohydrates on surface)**
* MANNER OF EXPOSURE
  + Transmitted via **Respiratory droplets** (person to person)
  + More prevalent in cooler months
  + **Peak incidence in children age 5-15 years**
* PATHOGENESIS
  + Several virulence factors (e.g. lipoteichoic acid, matrix-biding proteins that bind fibronectin, hyaluronate capsul, and M protein) mediate adherence to oropharynx epithelial cells 🡪 invade pharyngeal mucosa 🡪 PMNs recruited to fight invading S. pyogenes but M-protein (Major virulence factor) interferes with opsonization via the AP pathway, causing an antiphagocytic effect. Virulence factors, hyaluronic acid capsule and C5a peptidase, are also antiphagocytic.
  + S. pyogenes also has extracellular products such as Streptolysin O (a pore-forming cytolysin) and Streptolysin S (a hemolysin) that play a role in invading adjacent tissue planes, leading to **abscesses.**
  + Long-term **type specific humoral immunity** follows infection to one M-type, but **reinfection with another M-type is common.**
* SYNDOMES ASSOCAITED WITH STREPTOCOCCUS A INFECTION
  + **Abscesses**
    - E.g. Peritonsillar abcesses, otitis media, sinusitis, pneumonia
  + **Scarlet fever**
    - Rash appears (begins on trunk, spreading outward. Spares palms and soles)
      * Rash due to delayed type hypersensitivity to *erythrogenic toxin*
    - Strawberry tongue (red papillas on tongue)
  + **Acute Rheumatic Fever (ARF)**
    - Carditis, polyarthritis, chorea, and erythema marginatum
    - Rhematic heart disease
      * Caused by type II hypersensitivity reaction to molecular mimicry. *M protein Ags similar to cardiac antigens.* Over time, tolerance to autoantigens breaks down so immune response cross reacts with cardiac tissue, causing MAC (membrane attack complex) damage to heart valves.
* Treatment
  + **Penicillin and cephalosporins**
    - **If allergic to penicillin 🡪 erythromycin**
  + If treatment initiated within 9 days on onset, can prevent acute rheumatic fever (ARF)
* Factors leading to enhanced resistance and susceptibility
  + Crowded areas
  + Cooler months
  + Peak incidence age 5-15 years
  + No resistance to treatment been noted
* Vaccine Design
  + None
  + Currently in trial. The target for the vaccine is the surface M-protein but since there is much hypervariablilty in M protein with little cross protection, it is difficult.